The spastic velocity threshold predicts botulinum toxin-a treatment outcome in the medial hamstrings of children with cerebral palsy.

Introduction

Data collected using an innovative instrumented spasticity assessment (ISA) in the medial hamstrings (MEH) of children with cerebral palsy (CP) shows large variability among subjects in the velocity threshold (VT) at which hyperreflexia (spasticity) occurs. Intramuscularly injected Botulinum toxin-A (BTX) is effective in temporarily decreasing spasticity in the MEH, although a large variability in response is reported.

Purpose

To investigate whether the spastic VT pre-treatment can predict the effect of BTX in the MEH of children with CP.

Method

Forteen children with CP (10±2yrs) were measured pre- and post-BTX with 3D gait analysis (3DGA) and ISA. From 3DGA, improvement in knee extension during terminal swing ($Knee_{post}$) was analysed. During ISA, kinematics and electromyography (EMG) were recorded during slow and fast passive MEH stretches. Average normalized root mean square EMG was calculated pre-BTX during slow stretch (pre rms-EMG_{slow}) and post-BTX as the change between slow and fast (rms-EMG_{post}). Muscles with high rms-EMG_{slow} values pre-BTX were categorized as low-VT, those with low rms-EMG_{slow} values, as high-VT. Rms-EMG_{post} and $Knee_{post}$ were statistically compared between low-VT and high-VT muscles. The relationships between pre rms-EMG_{slow} with rms-EMG_{post} and with $Knee_{post}$ were investigated using Spearman correlations (significance $p<0.05$).

Results

Rms-EMG_{post} was lower (p=0.01) in those muscles categorised pre-BTX as high-VT. There were significant negative correlations for pre rms-EMG_{slow} with rms-EMG_{post} (r=-0.63) and with $Knee_{post}$ (r=-0.48) indicating that muscles with low-VT are less likely to respond to BTX, as assessed both passively and during gait.

Discussion and Conclusions

Assessment of the spastic threshold in the MEH in children with CP can be used to choose the most effective treatment for the individual patient. The etiology behind the different spastic thresholds requires further investigation.